Subject Index

A
α-helices
  amphipathic, 242
  orientation of, 243–44
Abdominal appendages, 503, 505–6
  functional demands of, 511
Abdominal gills, 714
Abstracts of Entomology, 266
Acanthoscelides obtectus, 432
A. woodi, 519, 523
Acarapis dorsalis, 522–23
Acari, 519–48
Acceptance
  producer, 187–88
Access
  free, 760–61
Accessory pulsatile organs
  evolutionary innovations in insects, 495–518
Accreditation
  of distance education, 756
Accrual
  of biomass, 95
Acetylcholine, 218–19
Acetylcholinesterase (AChE), 376, 383–84
  cloning, 384
  AChE
  See Acetylcholinesterase
Acroneuriinae tribes, 737
Activation
  of fat body lipases, 236
Activity rates
  climate and weather effects, 321, 323
Acute paralysis virus (APV), 535
Adaptability, 242, 431
  of patterns, 429–30
Adaptive plasticity, 358
Adherence junctions, 162
Adipocytes
  regulation of hormone-sensitive lipase in vertebrate, 236–37
Adipokinetic cells, 235
Adipokinetic hormones
  release of, 234–36
Adult biomass, 100–1
Adult growth, 100
Adult mortality, 100–1
Adult stage in insect production, 100–1
  Culicoides, 325
  emergence as function of larval production, 100
  fate of adult biomass, 100–1
Advances in Insect Physiology, 266
Aedes aegypti, 239, 379, 453
A. tritaeniorhynchus, 372
Aethina tumida, 529
  AEZs
  See Agro-ecological zones
AFLP
  See Amplified fragment length polymorphism
African agriculture
  pesticide use in, 640–42
African horse sickness virus (AHSV), 310–12
Africanized honey bees, 531
Agricultural production
  increasing, 635
  no-tillage, 181
Agro-ecological zones (AEZs), 633–36
Agroecosystems
  African, 631–59
  arthropod pests in, 175–201
  changes across years, 473–76
  role in maintaining biodiversity, 191
Agrotis segetum, 214, 218
AHSV
  See African horse sickness virus
Akabane virus (AKAV), 317
AKH release
  multifactorial process of, 251
AL
  See Antennal lobe
Aldehydes
  substituting for, 607
Alimentary canal
  genes in, 782–83
Alkyl chain
  isosteric replacement of, 610–12
  modifying, 606–7
All-electronic future
  changes in research literature, 761–62
  and cost recovery, 759–60
Allatostatins, 220
Allatotropin, 220
Allen Paradox
  prediction and, 98–99
Allometry slopes
  linear, 690–91
  steep, 671, 679–80
Allozymes
  in electrophoresis, 15
  in molecular systematics, 18, 24

Alta Vista, 762
Alternative food sources, 178–79
Alternative hosts, 181–82
Alternative prey, 181–82
Alternative splicing
  gene structure and, 452
Alumni career banks, 751
American foulbrood (AFB), 536–37
Amino acid substitutions, 380
Amino acid transport, 111–20
Amplified fragment length polymorphism (AFLP), 15, 291
  in molecular systematics, 19, 394
Analytical issues
  to combine or not to combine, 21
  gene trees versus species trees, 20
  in insect molecular systematics, 19–21
  phylogenetic methods, 19–20
Anastrepha, 439
Ancient DNA
  insect molecular systematics and, 24
Ancient remedies
  medicinal maggots, 55–81
Annals of the Entomological Society of America, 264
Annual cropping systems, 180, 481
Annual Review of Entomology, 265, 270
Annual variability, 329
Anopheles gambiae, 371–72
Antagonism, 585–87
  by chain length homologs, 586
  by compounds with different functional groups, 586
  by epoxide regioisomers, 586
  by the other enantiomer, 586–87
Antarctoperlaria
  cladogram of extant, 711
  and the Southern Hemisphere, 734–35
Antennal lobe (AL)
  circulatory organs within, 498–500
  function and morphology of, 203–31
  glomerulus innervation by neurons of, 209–10
  hormonal control in, 221
  interneurons and their synaptic interactions, 206–7
  and its glomeruli, 204–6
  neuroactive substances in, 218–22
  olfactory processing in, 222–23
  optical imaging of activity of, 210
  projections of olfactory receptor neurons, 209
  role of, 268–69
  schematic representation of, 205
Anti-Locust Research Centre, 274
Antibody inhibition studies, 248
Antimicrobial activity
  of maggot secretions, 71
AP-PCR
  See Arbitrarily primed PCR
Aphidophagous syrphids, 179
Aphis craccivora, 639
Apimaysin, 410
Apis cerana, 526, 528
A. mellifera, 519–21, 528
Apistan, 529
Apolipophorin III, 241–45
  lipid binding properties, 244–45
  open conformation model, 243–44
  structural properties of, 242–43
Appendage
  See Abdominal appendages
Apterygotes, 508
APV
  See Acute paralysis virus
Aquatic insect production, 83–110
Arbitrarily primed PCR (AP-PCR), 18
Arbovirus vectors, 307–40
Arctiidae, 582
Arctoperlaria, 718–33
  cladogram of extant, 711
  and the Northern Hemisphere, 735–36
  on southern continents, 736–38
Arginine, 245
Arid environments, 323, 326
Armor
  affect on growth rates, 91
Array
  See Glomerular array
Arthropod pests
  conserving enemies of, 175–201
  economic importance in Africa, 636–40
  life systems of polyphagous, 467–93
  mechanisms for habitat management of, 177–83
  mobility of, 472–73
  multivoltine, 479
Artifical selection experiments
  on morphological scale, 668–70
Asobara tabida, 436
Asymetrix Toolbook II
  software program, 755

Austroperlidae family, 718
Autonomy
of circadian clocks, 772, 785
Autoradiography, 275
Auxiliary circulatory structures, 495–518
Availability
See Host availability
Avascular nervous systems, 151, 159

B

Bacillus thuringiensis, 113, 190, 475
Backcrossing
to *berthaultii* (BCB), 407
repeated, 451
to *tuberosum* (BCT), 407
Bacteria
associated with varroa, 536–37
Bactrocera oleae, 434, 440
Baer, William, 61, 71
Barriers
See Blood barriers
BBB
See Blood-brain barrier
BBMV
See Brush border membrane vesicles
BEB
See Blood-eye barrier
Bee mites, 519–48
bees' resistance to tracheal, 525–26
parasitic, 521–34
sudden global emergence of, 537
Bee parasitic mite syndrome (BPMS), 535–36
Beetle banks, 187
BEFV
See Bovine ephemeral fever virus
Behavioral antagonists, 585–87
Behavioral mechanisms
in habitat management, 184–85
Bemisia argentifolii, 459, 471, 473
Benthic macroinvertebrate production, 102
Berliner toxins, 190
Bidirectional flow mode, 498
Binding
See Lipid binding properties; Reversibility lipid binding
Biochemistry
lipid transport, 233–60
of resistance, 374–77
Biodiversity
preserving, 23
role of agricultural landscapes in maintaining, 191
Biodiversity indicators, 564
Biogenic amines, 219–21
Biological Abstracts, 266
Biological control
in Africa, 646–47
habitat management and, 176
social wasps in, 142–43
Biological Reviews of the Cambridge Philosophical Society, 265
Biomass
accrual of, 95–96
fate of adult, 100–1
initial, 87
loss of, 95–99
secondary production of, 84
Biomembranes, 247
Biophysical analysis, 455–56
Biosynthesis, 411
of lipophorin, 240–41
of polyene and epoxide pheromones, 597–99
Biting insects
See *Culicoides*
Blend-detection
in polymorphic systems, 212–15
Blend specificity
concentration effects in, 216
in a pheromone communication system showing redundancy, 215–16
synergistic, 216
Blood barriers, 151–74
cell components of, 153–56
future prospects of, 168–69
membrane specializations responsible for, 156–58
molecular biology of, 165–68
specific barriers, 158–65
Blood-brain barrier (BBB), 152–53, 159–61
genesis of, 160
inducing therapeutic compounds across, 169
opening, 161
Blood-eye barrier (BEB), 161–62
Blood-nerve barrier, 158–59
Blood suckers
See *Culicoides*
Blood-testis barrier (BTB), 162–65
Blowflies, 56
Bluetongue virus (BTV), 312–15
in Africa, 313–14
in Asia, 314
in Australasia, 314–15
serology of, 314
Body appendage
See Abdominal appendages
Body cavity
central, 497–98
Body louse
resistance in, 373
Body size and armor
affect on growth rates, 91

Bombykol, 279
Bombyx mori
amino acid transport in larval, 112–14
Botanical instinct, 269–70
Bottom-up effects, 177
Bovine ephemeral fever virus (BEFV), 316–17
BPH
See Brown planthopper
BPMS
See Bee parasitic mite syndrome
Brain
genes in, 779–80
Branch lengths
concerns regarding, 14
Breeding sites
Culicoides, 308
Brood attractiveness, 531
Brown planthopper (BPH), 550
Brush border membrane vesicles (BBMV), 113
BTB
See Blood-testis barrier
BTV
See Bluetongue virus
Bulletin boards
in on-campus education, 750

C

Calliphora erythrocephala, 453
Callosobruchus maculatus, 437
Campaniform sensilla, 268–69
Cannibalism, 88
Capniidae family, 722–23
Capture of prey
in social wasps, 126–28
Carbohydrate resources
foraging for, 131–32
interactions on, 137–38
mobilizing, 237
Cardiac activity and physiology, 506–7
Career banks, 751
Carrying capacity, 471
Cassava green mite (CGM), 638
Cassava mealy-bug (CMB), 638, 646–47
Castes, 661
Catabolism
See Pheromone catabolism
Catalytic activity
of lipid transfer particles, 247–48
cDNA
cloning, 114, 319
CE algorithm
See Comparable evidence algorithm
Cell components
blood barriers, 153–56
meandering borders, 153–54
Cellular distribution
of insect circadian clocks, 769–93
Cellular rhythms, 771
Central body cavity, 497–98
Central nervous system (CNS)
expression of clock genes in, 779–81
Centrifugal neurons
anatomy and physiology of, 208
CGM
See Cassava green mite
Chain length homologs
antagonism by, 586
Chat rooms
in on-campus education, 750
Chelating agents (EGTA), 161
Chemical analysis, 279
Chemical control
of tracheal mites, 525–26
Chemoreception
basic research in, 622
Chloroperlidae family, 731–32
Choice of prey
cues in social wasps, 129–31
Chordotonal organs (COs)
assembly of, 159
protection of, 158–59
Chromatography, 279
Chromolipoproteins, 247
Chronic paralysis virus (CPV), 536
Chronobiology, 770–71
Chryptochrome
role of, 777–78
Chuzan virus, 316
Circadian clocks
autonomy of, 772, 785
entrainment of, 776–78
mechanism and distribution of insect, 769–93
rhythms described, 771
Circulatory organs
evolutionary innovations in, 510–13
phylogenetic pathways of, 507–9
structure and function of, 497–507
Cladography, 510, 711, 716, 733
Climate effects, 347
on *Culicoides*, 321–29
Clines
See Latitudinal clines
Clinical use of maggot therapy
increasing, 73
studies of, 60–63, 72
Clock genes
central nervous system expression of, 779–81
distribution and roles, 779–85
Cloning
of cDNA, 114

of major genes, 414
Closed season, 644
Cloudy Wing virus (CWV), 536
Clumped departures, 132
Clutch size
and progeny size, 346
CMB
See Cassava mealy-bug
CNS
See Central nervous system
Cos
See Chordotonal organs
Cochliomyia hominivorax
eradication of, 275
Cockroaches, 159, 429
Coding of odor blends, 211–16
concentration effects in, 216
in pheromone communication system, 215–16
in polymorphic systems, 212–15
time, 216–18
Codominant data sets, 18
Cogeners
antagonism by, 586
Coleoptera
amino acid transport in larval, 115–16
ovarian development in, 432–33
Colony development
among social wasps, 131
Colorado potato beetle (CPB), 399–411
Combinability
of data sets, 21
Communication
among entomologists, 262–67
See also Pheromone communication system
Communities
snag, 90
See also Social wasps
Community IPM, 559–60
Comparable evidence (CE) algorithm, 21
Comparative methods
phylogenetic, 21–23
Comparative studies
of morphological scale, 667–68
Competition
affect on growth rates, 92
Comprehensive Insect Physiology, Biochemistry and Pharmacology, 267
Computational power
increase in, 20, 262
See also Software tools
Concentration
effects in blend-specific neurons, 216
Conformation, 243–44
See also Molten globule conformation
Conservation, 191
of enemies of arthropod pests, 175–201
grassland, 191
habitat management and biological control, 176, 189
in phylogeny, 23
Constraints
on progeny size, 346
Cost recovery
all-electronic future and, 759–60
Costs
of distance education, 754
of fitness, 377
of the Internet, 751
Cotransport, 111
Cotton-wheat relay intercropping, 187–88
Course description and syllabus
online, 749
Course in a Box
software program, 755
Courses
recording, 754
CPB
See Colorado potato beetle
CPV
See Chronic paralysis virus
Crop associations, 643
Crop hosts, 469–72
Crop protection
assessment of loss, 550–51
and IPM in Africa, 631–59
Crop residues
management of, 181
Cropping systems
sequential, 469
temporarily unstable, 467–93
Culex, 374–75, 456
Culicoides, 307–40
abundance, 327–29
adult survival, 325
as barriers to virus dissemination, 318–19
biology and taxonomy, 308–9
breeding sites, 308
climate and weather effects, 321–29
effect of temperature on infection, 319–21
future research needed, 329–30
infection of, 318–21
larval development, 324
life cycle of, 308
non-vector species of, 320–21
seasonality, 322, 325–27
vector species of, 319–20
viruses associated with, 309–17
Cultural control
of tracheal mites, 525–26
Cuticular structure, 278
Cybercourses
benefits of, 756
in chemistry, 753
concerns about, 755–56
in entomology, 754–55

Cycling
midge-to-host-to-midge, 325
Cyclochampedol, 114
Cyclodiene resistance, 449–66
Cyrtodiopsis dalmanni, 669

D

DACT
See Dorsal antenno-cerebral tract
Dactylopius confusus, 240
DAG
See Diacylglycerol
Daphnia magna, 354–55
Data sets
codominant, 18
combinability of, 21
Data types, 293–94
Databases
of *Drosophila melanogaster* genome, 758
entomological, 757–58
DDT spraying, 372, 377
Defense-related pathways
manipulating in plants, 414
Deformed wing virus (DWV), 536
Delayed excitatory responses, 207
Delia platura, 428
Delta endotoxins
bacillus thuringiensis, 113
Dengue fever, 372
Density
maternal, 351
Departures
clumped, 132
Dephosphorylation, 237
Depolarization, 220
Desheathing studies, 159
Desiccation, 24, 323
contributing to pupal mortality, 99
resistance to, 353
Desynchronization, 219
Developing cybercourses
software aids in, 755
Developmental thresholds, 693–94
Diabetic foot ulcers
maggot debridement therapy for, 70
Diacylglycerol (DAG)
hydrolysis of stored TAG to, 234
Diallelic data sets, 18
Diaminobenzidine photoconversion, 250
Diamphipnoidae family, 717
Dieldrin
resistance to, 449–66
Diet/food availability
affect on egg size, 350–51
affect on insect, 666
Dimyristoylphosphatidylcholine (DMPC), 244
Diptera, 56
ovarian development in, 433–35
Direct sensory effects
of hosts on ovarian development, 431–35
Discontinuous scaling releationships, 694–96
Discussion groups
in entomology research, 757
in on-campus education, 750
Disease
See Human disease
Disjunct-hierarchy approach, 734
Disks large gene (dlg), 166
Dispersal
climate and weather effects, 323–24
Dispersal-reproduction tradeoffs, 437–38
Disruption
mating, 620–21
of phospholipid bilayer, 245
Distance education, 752–56
accreditation of, 756
concerns about, 755–56
courses in entomology, 754–55
growth in, 753–54
implementing, 754–55
Distribution, 709
of the GABA receptor, 453
Disturbance
and loss of biomass, 96–97
moderating, 189
Disulfide bonding, 244
Diuraphis noxia
resistance to, 399
Diversionary hosts, 643
Diversity
added in habitat management, 186–87
genetic, 288–93
providing "right," 177–78
DMACT
See Dorso-medial antennocerebral tract
DMPC
See Dimyristoylphosphatidylcholine
DNA
ancient, 24
repetitive, 17
satellite, 17
DNA DataBank of Japan, 758
DNA sequencing, 291, 299
alternatives to, 14–15
of cloned disease-resistance genes, 414
mitochondrial, 4
in molecular systematics, 15–18
mtDNA, 15–16
noncoding markers, 17–18
nuclear DNA, 16
Dolichovespula maculata, 129
Domain structure analyses, 236
Dopamine staining, 219

Dorsal antenno-cerebral tract (DACT), 208
Dorsal flow
bidirectional, 497
Dorso-medial antenno-cerebral tract (DMACT), 208
Dose-response curves, 455
Dropping mites
to control varroa, 530
Drosophila melanogaster, 4, 17, 22, 118, 167–69, 240, 349, 352–53, 455–58, 668, 687, 770–74
blood-brain barrier in, 153–54, 160–61
blood-eye barrier in, 161–62
blood-nerve barrier in, 158–59
cloning, 382, 449
genomic database of, 758
larval stage in, 455
DWV
See Deformed wing virus

E

E-mail
in entomology research, 757
in on-campus education, 750
EAG
See Electroantennogram
Eastern equine encephalomyelitis virus, 309
Ecological Entomology, 264
Ecological Society of America, 266
Ecological theory
contribution to habitat management, 189
Economic impacts
of arthropod pests in Africa, 636–40
threshold point in insecticide application, 552–53
Ecosystems
reliance on a balanced paddy, 550–51
Education
means of, 560
on-campus, 748–51
uses of, 562, 648–49
EEV
See Equine encephalosis virus
Egg load, 423, 425–27
Egg order
female age and, 356–57
Eggs, 87–88
Culicoides, 309
effect of selection on size of, 347–48
first-instar, 88
hatching synchrony, 87–88
mortality of, 87, 356
numbers of, 424–25
patterns of maturation, 425–29
EGTA
chelating agents, 161
EHDV
See Epizootic hemorrhagic disease virus
El Niño Southern Oscillation (ENSO), 328
Electrical activity
in insect vision, 161–62
Electroantennogram (EAG) activity, 269, 607–11
Electron impact (EI) mass spectra, 587–92
Electron microscopy, 278–79
transmission, 152, 269
Electrophoresis, 275
allozyme, 15
Electrophysiology, 615–16
of antennae, 268–69
Electrostatic interactions
between amino acid side chains and phospholipids, 245
Emergence of adults
a function of larval production, 100
Emerging pests, 640
Emigration/immigration
and loss of biomass, 97–98
Enantiomeric antagonism, 586–87
Enantiomeric purity, 579–80, 582, 595
Enantiomers
blends of, 585
Encyrtid parasitoids, 426, 428
Endocrine glands
genes in, 781–82
Endocytotic uptake, 249–50
Endopterygotes, 509
Endosulfan resistance levels, 457
Enemies of arthropod pests
constraining factors, 180–81, 190
habitat management for conserving, 175–201
Energy production
lipid transport biochemistry role in, 233–60
Enhancement
See Local enhancement of foraging
ENSO
See El Niño Southern Oscillation
Entomo-L, 757
Entomological Society of America, 759
Entomology
databases on, 757–58
distance education courses in, 754–55
impact of Internet on teaching and research, 747–67
in the twentieth century, 261–85

Entomology Abstracts, 266
Entomology Index of Internet Resources, 757
Entomopathogenic nematodes
  controlling arthropod pests with, 287–306
Entrainment
  of circadian clocks, 776–78, 785
Environmental Entomology, 264
Environments
  adaptability to, 396
  arid, 323, 326
  uncertainty of host, 436
Epilachna niponica, 436
Epiproct basal process, 713
Epizootic hemorrhagic disease virus (EHDV), 315–16
Epizootic zones, 311–13
Epoxide regioisomers, 575–603
  antagonism by, 586
  defined, 578
  mixtures of, 585
Equine encephalosis virus (EEV), 309, 316
Essential oils
  to control varroa, 530
Establishing new plant species
  concerns regarding, 187
Esterase-based resistance, 374–75
Esterases
  transcriptional regulation, 378–79
Esters
  halogenating, 609–10
ESTs
  See Expressed sequence tags
Ethanol preservation, 24
Eucaryotes
  genome of, 289
Euholognatha group, 719–26
European foulbrood (EFB), 536
European Molecular Biology Library, 758
Eustheniidae family, 717
Eusthenioidea group, 716–17
Euthyplocia hecuba, 89
Euvarroa sinhai, 533–34
Evolution
  of exaggerated morphologies, 661–708
  and genetic improvement, 297
  molecular, 22–23
  organismal, 22
  of scaling releationships, 666–70
Evolution, 272
Evolutionary ecology
  of progeny size in arthropods, 341–69
Evolutionary innovations
  in circulatory organs, 510–13
  in insects, 495–518
Exaggerated morphologies
  evolution of, 661–708
Exchangeability, 242, 244
Excitatory responses, 207
Exopterygotes, 508–9
Expressed sequence tags (ESTs), 415
Expression of the GABA receptor, 454–55
Eye
  See Optic lobe

F

FA
  See Fatty acids
Facultative trait expression, 686
Fahraeus-Lindquist effect, 510
FAO
  See United Nations Food and Agriculture Organization
Farmer Field Schools (FFSs), 557–61, 564, 649
Farmer first programs, 557–60, 564–65
Fast-drying
  See Desiccation
Fat body lipases
  activation and specificity of, 236
  TAG lipase, 251
Fatty acids (FA), 236
Feedback loop
  molecular, 776
Feeling for insects, 279–80
Female age
  and egg order, 356–57
Female size, 349–51
Females
  variation among eggs and progeny produced by individual, 355–57
  See also Maternal diet/food availability
FF
  See Freeze-fracture studies
FFSs
  See Farmer Field Schools
Field crop pests, 637–39
Fifth Internet Congress for Biomedical Sciences, 757
File Transfer Protocol (FTP)
  in entomology research, 757
Filter feeders, 94
First-instar eggs, 88
Fitness
  in the absence of pesticide, 460–61
  cost of, 377
Flapping gills, 713–14
Flight
  lipid mobilization and transport during, 251
Flight tracking, 614–15
Flooding
  effects on mortality, 90, 324

Floral nectar, 178
Florida Entomological Society, 267, 761
Fluorescence microscopy, 278
Fluorine
special properties of, 609
Fluvalinate, 529, 532
Fly larvae
See Maggot debridement therapy
Flybase, 758
FMRFamide, 220
Focal spraying, 371–72
Food sources
alternative, 178–79
limitation of, 91–92, 141–42
pest insects used as, 645–46
Foraging
behavior of social wasps, 121–50
carbohydrate, 131–32
local enhancement of, 134
Formates
substituting for aldehydes, 620
Formic acid
to control varroa, 525–26, 530
"Forty Days" campaigns, 556–58, 564
Fourier transform infrared (FTIR) spectra, 587
Free access
to journal articles, 760–61
Freeze-fracture (FF) studies, 165
FTIR
See Fourier transform infrared spectra
FTP
See File Transfer Protocol
Fungi
associated with varroa, 537

G

Galleria traps, 288
Gamma-aminobutyric acid (GABA) transporters, 114, 218–19
receptors, 376–77, 382, 453–55
Gas chromatography (GC), 279, 587, 592
GenBank, 4, 758
posting sequences to, 25
Gene amplification, 378
Gene structure
and alternative splicing, 452
in molecular systematics, 18
Gene trees
incongruence among, 20
versus species trees, 20
Genes
cloning, 451–52
identifying, 297
in insect-resistant crops, 398–99
mapping, 394–413, 451
Genetic diversity, 288–93
and egg size, 355
genome size and complexity, 289
genotype distribution, 292
measures of, 290–92
population structure and species delimitation, 292–93
Genetic improvement, 297–98
evolutionary aspects, 297
identification of genes, 297
molecular markers, 297–98
Genome databases, 757–58
of Drosophila melanogaster, 758
Genome size and complexity, 289
Genomics
linking QTL mapping with, 415
Genotypes
connecting to phenotypes, 686–96
distribution of, 292
identifying, 3
regulating trait expression, 695
Geographic variation, 348
Geometridae, 580–81
Germplasm databases, 757–58
Gill remnants, 713
Glial cells
barrier properties of, 155–56
Globule conformation
See Molten globule conformation
Glomerular array, 222
functional correlates in, 209–11
sexually isomorphic, 204
Glomerulus innervation, 222
by neurons of the antennal lobe, 209–10
Glucosinolates, 270
Glutamate uptake, 117–18
Glutathione S-transferases (GSTs), 379–80
resistance based on, 374–75
Glycoalkaloids, 407
Glycoproteins
novel, 168
Gnats
See *Culicoides*
Gondwanaland
breakup of, 737
Graduate education
advantages of distance education for, 754–55
Grasses, 184
Grassland conservation, 191
Gripopterygidae family, 718
Gripopterygoidea group, 717–18

Grooming
helping to control varroa, 531
Ground covers, 181
pollen-producing, 187–88
Group dynamics exercises, 558
Group living, 123
Growth
in distance education, 753–54
Growth-promotion activity
of maggot secretions, 71–72
Growth rates
factors controlling, 90–92
rapid, 89–90
slow, 88–89
See also Tissue growth
GSTs
See Glutathione S-transferases

H

Habitat
for mites, 520
Habitat diversity
negative aspects of added, 186–87
within seasons, 469–72
Habitat management
and conservation biological control, 176
for conserving enemies of arthropod pests, 175–201
contributions of theory and modeling to, 188–89
implementing, 183–90
mechanisms for, 177–83
supplementing with other methods, 190
Habitat template
affect on growth rates, 90–91
Hairless Black Syndrome, 536
Handling of prey
in social wasps, 126–28
Haplotypes, 291
Harvest time
adjusting, 643–44
Hatching synchrony
egg, 87–88
HBTM
See Honey bee tracheal mites
Head louse
resistance in, 373
Healing
See Maggot debridement therapy
Heartbeat reversal, 498, 509
Hearts
insects rich in, 496, 513
Heat
to control varroa, 531
Helicoverpa armigera, 461, 638
H. zea, 208, 399, 408, 472, 475, 479–80
Heliocheilus albipunctella, 637
Heliothis zea, 247, 620–21
Hemispheres
of Plecoptera, 734
Hemodynamic principles, 510–11
Hemolymph, 161, 163
lipids released into, 238, 251
mechanics of circulation, 495–518
protection from, 158
tracers in, 164
viscosity of, 510
Heteroplasmy, 15
Heterorhabditis, 287–99
High pressure liquid chromatography (HPLC), 592
Histidine uptake, 115
History of Entomology, 261
Homologization, 513, 586
Honey bee tracheal mites (HBTM), 521–26
recent evolution of, 522–24
Honey bees
mite-associated pathologies of, 535
parasitic mites of, 519–48
Hormonal control
in the antennal lobe, 221
Hormone-induced lipid mobilization
adipokinetic, 234–39
Hormone-sensitive lipase
regulation in vertebrate adipocytes, 236–37
Hormones
and regulation of tissue growth, 688–90
Host availability
and host sensory cueing, 435
variation in, 426–28, 474–75
Host conditions
host stimuli as useful indicators of, 438–39
Host preference, 467
in multitrophic interactions, 296–97
Host quality
and host sensory cueing, 435
nutritional effects of, 430
variation in, 428–29
Host resource
patterns of egg maturation in relation to, 425–29
Host sensory cueing
in relation to host quality and availability, 435
Host specialization
ovarian dynamics and, 440
Hosts
alternative, 181–82
changes in suitability, 475–76
direct sensory effects on ovarian development, 431–35

diversionary, 643
ovarian dynamics and, 423–48
resistance in, 393, 647
See also Oviposition behavior
HotBot, 762
HPLC
See High pressure liquid chromatography
HTML
See Hypertext Markup Language
Human disease
insecticide resistance in insect vectors of, 371–91
Human low-density lipoprotein receptor homologue, 250
Human pathogens, 309
Hunting
patterns of, 131
See also Foraging
Hybridization, 293, 297, 562
Hydrophobic sensor, 245
Hygienic behavior
helping to control varroa, 531
Hymenoptera: Vespidae, 121–50, 680
Hyperosmotic mechanism, 161
Hypertext Markup Language (HTML) Web pages
translating Microsoft PowerPoint slides into, 754
Hypothenemus hampei, 458–59

I

IACT
See Inner antenno-cerebral tract
ILD test
See Incongruence length difference test
Imaging techniques, 277–79
Immuno-electron microscopy, 235
Immunocytochemical staining, 220
Immunocytochemistry
impact on insect studies, 277
Immunology, 276–77
Immunoreactivity, 207
to maggots, 73–74
Incongruence length difference (ILD) test, 21, 296
Ingroup taxa
selecting, 14
Inheritance
patterns of, 318
quantitative, 395
Inhibitory postsynaptic potential (IPSP), 217
Inhibitory responses, 207
antibody, 248
of pheromones, 613–14
Inner antenno-cerebral tract (IACT), 207
Innervation
See Glomerulus innervation
Insect circadian clocks
mechanism and distribution of, 769–93
Insect genome
ability to manipulate, 385
Insect molecular systematics
analytical issues, 19–21
and ancient DNA, 24
current state of, 1–54
methods in, 10–19
preserving specimens for molecular study, 23–24
previous research on, 2–10
using phylogenies, comparative methods, 21–23
Insect pests
See Arthropod pests
Insect/plant relations, 269–73
Insect production, 83–110
adult stage in, 100–1
larval stage in, 88–92
pupal stage in, 99–100
Insect resistance
genetic resources for, 415–16
Insect-resistant crops
future of study, 413–16
genes in, 398–99
tagging and mapping in, 393–422
Insect sequences
growing database of, 4
Insect vectors of human disease
insecticide resistance in, 371–91
scale of problem, 372–74
"Insectary hedgerows," 183
Insecticide binding, 374
Insecticide metabolism, 374
Insecticide resistance
cyclodiene, 449–66
in insect vectors of human disease, 371–91
management of, 384–85
Insecticide use
early-season, 551–52
reducing, 558–59
Insects
amino acid transport in, 111–20
blood barriers of, 151–74
carrying apparatus, 275
distribution of clock genes in, 779–85
evolution of exaggerated morphologies in, 661–708
evolutionary innovations in, 495–518
feeling for, 279–80
landmark events in study of, 262–63
regulation of substrate mobilization in, 237–39
rich in hearts, 496
See also Arthropod pests
Insects: Structure and Function, The, 267

Instinct
botanical, 269–70
Integrated pest management (IPM) projects, 530
development of technology for, 646–49
in tropical Asian irrigated rice, 549–74
Interactions
on carbohydrate resources, 137–38
multitrophic, 295–97
on prey, 138–39
Interconversions
subspecies, 241–42
Intercropping, 181
cotton-wheat relay, 187–88
Internal transcribed spacer (ITS) region, 291
International Biotherapy Society, 62–63
International Congress of Entomology, 263
International Insect/Hostplant Symposium, 270
International nucleotide Sequence Database Collaboration, 758
International Rice Research Institute (IRRI), 554, 563
Internet
brief history of, 747–48
concerns about, 751–52, 755–56
costs of, 751
impact on distance education, 752–56
impact on research, 756–62
impact on teaching, 748–52
Internet conferences, 757
Interneurons in the antennal lobe (AL)
and their synaptic interactions, 206–7
Interpretive tools, 294
Introduced species
social wasps, 140–42
Introns, 16–18
noncoding, 17
IPM
See Integrated pest management
IPSP
See Inhibitory postsynaptic potential
Isolates, 288
Isosteric replacement
of alkyl chain, 610–12
Isotope labeling
See Radiolabeling
ITS
See Internal transcribed spacer region

J

Jasmonic acid (JA) pathway, 414
Journal articles
predicted free access to, 760–61
predicted move to Web, 758–59
Journal of Insect Physiology, 264
Journals, 263–64, 267
Junctions
See Septate junctions; Tight junctions
Juvenile hormone (JH), 221, 433, 693–94

K

Kashmir bee virus (KBV), 536
Kenyon fibers, 453

L

L-tyrosine uptake, 116
Labeling
See Radiolabeling
Land Surface Temperature (LST) estimates, 328–29
Landmark memories, 129
Landscapes
arthropod pests in agricultural, 175–201
heterogeneity in, 188–89, 191
Lara avara, 88, 91
Larval stage in insect production, 88–92, 92–94
Culicoides, 309
decisions made during, 690–91
fate of, 95–99
high, 93–94
long life cycles, 88–89
low, 94
rapid growth rates, 89–90
short life cycles, 89–90
slow growth rates, 88–89
Larval therapy
See Maggot debridement therapy
Larval tissue
separation from adult tissues, 687–88
Laser-scanning microscope, 277–78
Latitudinal clines, 349
LCCH3
See Ligand gated chloride ion channel homolog 3
Leaf-feeding insects
beliefs about, 556–57
Leaky gut phenomenon, 320, 330
Legs, 501–2
Lepidoptera
amino acid transport in larval, 112–15
hemolymph circulation in legs of, 501
ovarian development in, 431–32
selective pressures on prey, 139–40
sex attractant pheromones in, 575–603

Leptinotarsa decemlineata, 211–12, 399–411
leucine uptake in, 115
Leucine affinities, 114–15
Leuctridae family, 723–24
Leuctroidae family, 721–22
Lice
resistance in, 373
Life cycles
long, 88–89
short, 89–90
of stream insects, 83–110
Ligand gated chloride ion channel homolog 3 (LCCH3), 454–55
Light
sensitivity of *tim* gene to, 776–77
Light microscopy, 277–78
Limitation
See Food sources
Linear allometry, 690–91
Lipid binding properties
of apolipophorin III, 244–45
Lipid mobilization
adipokinetic hormone-induced, 234–39
Lipid transfer particles (LTPs), 246–49
catalytic activity and substrate specificity of, 247–48
mechanism of LTP-mediated lipid transfer, 248–49
physical and structural properties of, 246–47
Lipid transport biochemistry
role in energy production, 233–60
Lipophorin
biosynthesis of, 240–41
interaction with fat body cells, 249–50
structure of, 239–42
subspecies interconversions of, 241–42
Lipophorin receptors, 249–50
Lipophorin shuttle hypothesis, 242, 246
Lipoprotein receptor homologue
human low-density, 250
Liquid substrate specificity, 247–48
LNs
See Local neurons
Lobularia maritima, 184
Local enhancement of foraging, 134, 136
Local neurons (LNs)
anatomy and physiology of, 207
Location of prey
cues in social wasps, 129–31
Locusta migratoria, 234–35, 243, 249
Long chain fatty acids
See Fatty acids
Long life cycles
larval, 88–89
Loss of biomass, 95–99
disturbance, 96–97
emigration/immigration, 97–98
molting and silk production, 95–96
prediction and the Allen Paradox, 98–99
LST
See Land Surface Temperature estimates
LTP-mediated lipid transfer
mechanism of, 248–49
LTPs
See Lipid transfer particles
Lucilia sericata, 58, 60, 71
Lygus, 470
Lymantriidae, 582–58

M

Macroglomerular complex (MGC), 204
Macroinvertebrate production, 94, 102
MACT
See Middle antenno-cerebral tract
Maddison's Tree of Life, 21
Maggot debridement therapy (MDT)
biochemical basis of, 70–71, 77
biology and natural history of, 56–60
clinical studies, 72
current status of, 63–70
for diabetic foot ulcers, 70
early techniques for producing and applying, 63
future status of, 72–74
history of, 60–63
increasing clinical use of, 73
medicinal, 55–81
for nursing home patients, 68
optimizing the treatment, 73
selecting patients for, 64–67
species of flies used in, 58–60
veterinary use of, 77
Maggot production
optimizing, 73
Maggot secretions
antimicrobial activity of, 71
growth-promoting activity of, 71–72
MAGs
See Monoacylglycerols
MAGUKs
See Membrane associated guanylate kinase homologs
Malaria eradication, 371
Malathione-resistant strains, 377
Malpighian tubules, 785

Mamestra brassicae, 204
Management
See Habitat management
Manduca sexta, 169, 204, 217–19, 687
amino acid transport in larval, 114–15
Manipulating defense-related pathways
in plants, 414
Mannitol, 161
Mapping
insect resistance loci in plants, 393–422
major genes and QTLs for plant resistance to insects, 398–99
Mariner transposon distribution, 22–23
Marker-aided selection (MAS), 395
Markers
molecular, 14–15, 297–98
previous research on, 4–10
Marketing
of parapheromones, 621
MAS
See Marker-aided selection
Mass media
motivation by, 556–57
Mass trapping
using parapheromones, 619–20
Maternal density
affect on egg size, 351
Maternal diet/food availability
affect on egg size, 350–51
Mating disruption
using parapheromones, 620–21
Matrices
Sepharose, 248
Maximum likelihood methods, 294
Maximum parsimony methods, 294
Maysin pathway, 410, 415
MDT
See Maggot debridement therapy
Meandering cell borders, 153–54
Megalurothrips sjostedti, 638
Membrane associated guanylate kinase homologs (MAGUKs), 166–67
Membrane permeability mechanisms, 111
Membrane specializations
pleated-sheet septate junctions, 155–57
responsible for blood barriers, 156–58
tight junctions, 157–58
Metabolic mechanisms of resistance, 377
Metapopulation processes, 468
Methanonine uptake, 116
MGC
See Macroglomerular complex
Microclimate shelters, 177, 179–83
Microsatellites, 17, 394
Microscopic Anatomy of Invertebrates, 267
Microscopy
electron, 278–79
fluorescence, 278
immuno-electron, 235
laser-scanning, 277–78
light, 277–78
transmission electron, 152, 269
Microsoft PowerPoint slides
translating into HTML Web pages, 749, 754
Microsomal triglyceride transfer protein (MTP), 246
Middle antenno-cerebral tract (MACT), 207–8
Midge-to-host-to-midge cycling, 325
Midges
See *Culicoides*
Migrations
tracking, 273
Migratory pests, 639–40
Mimicry
of pheromones, 613–14
Mischocyttarus flavitarsis, 129–30
Mitchell River virus, 309
Mite fecundity
low, 531–32
Mites
hive as a habitat for, 520
of honey bees, 519–48
Mitochondrial DNA (mtDNA)
information content of, 15–16
sequences of, 4–9
Mixtures
in insecticide application, 384
Modeling
contribution to habitat management, 188–89
Modicogryllus confirmatus, 438
Molecular biology
of blood barriers, 165–68
characterization in, 298
and cyclodiene resistance, 449–66
impact of, 287–306
preserving specimens for, 23–24
of resistance, 377–84
Molecular Entomology, 264
Molecular evolution
phylogeny of, 22–23
Molecular feedback loop, 776
Molecular markers, 297–98
advantages of, 395–98
and gene mapping, 394–413
and genetic improvement, 297–98

using to determine mechanisms of insect resistance, 399–411
using to increase the durability of insect-resistant crops, 411–13
Molecular mechanism
of insect circadian clocks, 769–93
Molecular rhythms
described, 771
Molecular systematics
AFLP, 19
allozymes, 18
current state of insect, 1–54
DNA sequences, 15–18
DSCP, 19
gene arrangements, 18
markers, 14–15
methods, 10–19
RAPD, 18–19
RFLP, 18
sampling, 14
SSCP, 19
Molten globule conformation, 245
Molting in silk production
and loss of biomass, 95–96
Monitoring
using parapheromones, 619–20
Monoacylglycerols (MAGs), 236
Monoculture
increasing crop with, 177
Mononychellus tanajoa, 638
Monooxygenases, 381
resistance based on, 375–76
Morphology
of antennal lobe, 203–31
evolution of exaggerated, 661–708
interaction of traits, 696–97
size-dependent expression of traits, 664–66
Mortality
adult, 100–1
in eggs, 87
sources of, 101
Mosaics, 384
shifting, 467
Mosquito
resistance in, 372–73
Mouthparts, 501
Mowing
alternate inter-row, 188
mtDNA
See Mitochondrial DNA
MTP
See Microsomal triglyceride transfer protein
Multi-locus data sets, 18
Multiglomerular local neurons, 204, 207
Multitrophic interactions, 295–97
host preference, 296–97
mutualistic history, 296
mutualistic specificity, 295–96
Multivoltine pests, 479
Musca domestica, 377, 379, 383
Mutants, 450, 455–56
of *Drosophila melanogaster*, 450
insecticide resistance of, 450
Mutualistic specificity
in multitrophic interactions, 295–96
Myiasis, 57–60

N

Natural enemies of arthropod pests
constraining factors, 180–81, 190
habitat management for conserving, 175–201, 552, 647
Natural selection, 341
Nature conservation
See Conservation
NDVI
See Normalized Difference Vegetation Index
Nectar
floral, 178
Nematodes
entomopathogenic, 287–306
Nemouridae family, 724–26
Nemouroidea family, 720
Nemouromorpha family, 721
Neoperla genus, 736
Nervous systems
avascular, 151, 159
Nest construction, 122–23
Nestmates
aggression among, 137–38
Networked Digital Library of Theses and Dissertations (NDLTD), 762
Neurexin IV, 168–69
Neuroactive substances
in the antennal lobe, 218–22
biogenic amines, 219–20
neuropeptides, 220
neurotransmitters, 111, 218–22
nitric oxide, 220–21
Neurocytotoxic plant products, 169
Neurons and interneurons, 206–8
Neuropeptides, 220
Neurospora crassa, 770
Neurotoxins
reducing, 169
Neurotransmitters, 111
acetylcholine and GABA, 218–19
receptors, 382
Nezara viridula, 470
Nicotinic acetylcholine receptor, 376

Nicrophorous tomentosus, 432–33
Nilaparvata lugens, 550
Nitric oxide (NO), 220–21
No-see-ums
See *Culicoides*
No-tillage production systems, 181
Noctuidae, 581–82
Noncoding markers, 17–18
in DNA sequences, 17–18
Nonlinear scaling releationships, 696–97
Nontraditional students
reason for growth in distance education, 753–54
Normalized Difference Vegetation Index (NDVI), 328–29
Nosema apis, 521
N. pyrausta, 478
Notonemouridae family, 724–25, 737–38
Nuclear DNA
sequences of, 16
Nuclear protein-coding genes, 16
Nuclear protein-coding loci, 11–13
Nuclear rDNA
sequences of, 4, 10
Nuclear ribosomal RNA genes, 16, 294
Nuisance insects
role as arbovirus vectors, 307–40
Nursing home patients
maggot debridement therapy for, 68
Nutritional effects
of host, 430
Nyabira virus, 316

O

OACT
See Outer antenno-cerebral tract
Odors
coding of blends of, 211–16
fluctuating concentrations of, 203
plumes of, 216
spatial mapping of, 211
ODPs
See Oviposition deterring pheromones
Oestridae, 57
Olfaction
in the antennal lobe, 222–23
Olfaction research, 268–69
parapheromones in, 605–30
Olfactory prey cues, 124, 128–30
Olfactory receptor neurons (ORNs)
activity of parapheromones on, 615–16
anatomy and physiology of, 204, 206, 222
antennal lobe projections of, 209
pheromone-specific, 210
On-campus education
use of Internet in, 748–51
Onchocerciasis Control Programme, 373
Online textbooks, 750
Onthophagus acuminatus, 666, 669, 684
Oogenesis, 423, 429
stimulation of, 433
Open conformation model of apolipophorin III, 243–44
Optic lobe
genes in, 780–81
Optical imaging
of activity in the antennal lobe, 210
Optimal progeny size, 342
Organ design
principles of, 512–13
Organic matter
adding, 181
Organismal evolution
phylogeny of, 22
Organophosphate (OP) resistance, 373
Orientation flights
in social wasps, 128–29
ORNs
See Olfactory receptor neurons
Oropouche virus (OROV), 307, 309–10
Orthoptera Species File, 758
Oryza sativa, 549
Oscinella frit, 433
Osmia, 265
Ostrinia nubilalis, 212–14, 477–79, 620
Outer antenno-cerebral tract (OACT), 208
Outgroup taxa
selecting, 14
Ovarian development, 441–42
basic design and control of, 424–25
direct sensory effects of hosts on, 431–35
plant defenses aimed at, 439–40
trade-offs associated with, 436
Ovarian dynamics
coevolutionary aspects, 439–41
and host use, 423–48
mechanisms underlying, 429
Ovarian responses to host variation
conditions favoring, 435–39
Ovaries
genes in, 783
Overwintering
See Seasonality

Oviposition behavior, 429–30, 441
affect on egg size, 351
Oviposition deterring pheromones (ODPs), 211
Ovipositors, 505–6

P

Palyam viruses, 316
PAML
See Phylogenetic Analysis by Maximum Likelihood
Pangaea
breakup of, 709
Papilio, 10
Paradigm shifts, 553–54
Parallel publication, 759
Parapheromones
future of, 621–22
modifying insect behavior, 614–15
in olfaction research and pest control strategies, 605–30
physiological and behavioral effects of, 613–19
practical uses of, 619–21
structural diversity of, 606–13
toxicity of, 618–19
Paraphyly, 738
Parasitic mites
of honey bees, 519–48
of other species of *Apis,* 534
Parasitoids
encyrtid, 426, 428
mechanisms for habitat management of arthropod, 177–83
vineyard, 185
Parental investment, 341
and progeny size, 346
PASA
See PCR Amplification of Specific Alleles
Paternal effects
on egg size, 351–52
Patterns
adaptability of, 429–30
tritrophic, 440
Patterns of inheritance, 318
PAUP
See Phylogenetic Analysis Using Parsimony
PBAN
See Pheromone biosynthesis activating neuropeptide
PCR
See Polymerase chain reaction
PCR Amplification of Specific Alleles (PASA), 456
Pediculus humanus, 373
Peltoperlidae family, 728, 729
Penicillin
affect on maggot therapy, 62
per gene
discovery and characterization of, 773–74
regulation of, 775
Perennial crop systems, 180
Perilipins, 237
Perineurial cells
barrier properties of, 153–55
Peripheral tissues
genes in, 781–85
Periplaneta americana, 117, 219, 507, 511, 607–8
Perlidae family, 732–33
Perlodidae family, 730–31
Perloidea group, 729–33
Permeability barriers, 151, 159
Pest management strategies, 537, 619
with entomopathogenic nematodes, 287–306
mechanical, 644
parapheromones in semiochemical-based, 605–30
quarantine regulations, 647–48
in traditional African agriculture, 631–59
See also Arthropod pests; Integrated pest management
Pesticides, 176
fitness in the absence of, 460–61
obsolete and unwanted, 641–42
reducing neurotoxic, 169
unreasonable promotion of, 553
use in African agriculture, 640–42
P450 monooxygenases, 375–76
Phacelia tanacetifolia, 184–85
Pharmacology
of the GABA receptor, 453–54
Phenacoccus manihoti, 638
Phenotypes
connecting genotypes to, 686–96
uncoupling of large and small individuals, 683–85
uncoupling of males and females, 685–86
"Pherolist," 576
Pheromone analogues, 605–6, 613
Pheromone biosynthesis activating neuropeptide (PBAN), 597
Pheromone catabolism
activity of parapheromones on, 616–18
Pheromone communication system
redundancy in, 215–16
Pheromone production
activity of parapheromones on, 618

Pheromone signals
components of, 584
mechanisms to generate unique, 583–87
Pheromone-specific olfactory receptor neurons, 210
Pheromone synthesis
biosynthesis of polyene and epoxide, 597–99
of components, 592–96
Pheromones, 578–80
analyzing and identifying components, 587–92
effect of parapheromones on, 613–14
isotopically labeled, 612
mixed chain lengths, 584
numbers of double bonds, 584–85
sex attractant, 204, 575–603
for social control, 520
structures and nomenclature, 576–78
taxonomic distribution of polyene and epoxide, 578–83
trail, 143
See also Parapheromones
Philosamia cynthia
amino acid absorption in, 112
Phosphatidylcholine vesicles
binding to, 245
Phosphorylation, 236
of proteins, 775–76
Photoconversion
by diaminobenzidine, 250
Photoperiodism, 770
Photoreceptivity
of peripheral clocks, 785
Photoreceptors
genes in, 781
PHYLIP
See Phylogenetic Inference Package
Phylogenetic Analysis by Maximum Likelihood (PAML), 20
Phylogenetic Analysis Using Parsimony (PAUP), 20
Phylogenetic databases, 758
Phylogenetic Inference Package (PHYLIP), 20
Phylogenetic methods, 19–20, 295
comparative, 21–23
conservation, 23
molecular evolution, 22–23
organismal evolution, 22
reconstruction, 287–306
Phylogenetic pathways
of circulatory organs, 507–9
Phylogenies
molecular, 22
of the plecoptera, 709–46
of social wasps, 123
and their congruency, 294–95
Physiological Entomology, 264
Physiology of Insecta, 266
Phytophagia, 269
Pieris brassicae, 270–71
Pissodes strobi, 439–40
Plant breeding, 393
Plant defenses
aimed at ovarian development, 439–40
natural pest control, 645
Plant fibers, 122–24
Plant species selection
in habitat management, 184
Planting time
adjusting, 643–44
Pleated-sheet septate junctions, 155–57
Plecoptera, 709–46
cladogram of extant, 711
monophyly of, 710–14
phylogenetic relationships among, 714–33
suborders of, 734
zoogeography of, 733
Plowing
with alternate inter-row mowing, 188
Plumes, 216
Plutella xylostella, 431–32
PMS
See Bee parasitic mite syndrome
PNs
See Projection neurons
Polar group
modifying, 607–8
Policy environment, 560–61
Polybia occidentalis, 124, 138
P. sericea, 128–29
Polyene hydrocarbons, 575–603
with corresponding monoepoxide, 584–85
Polymerase chain reaction (PCR), 117, 290
arbitrarily primed, 18
diagnostic test based on, 383
reverse transcriptase, 16
Polymorphic systems
blend-detection in, 212–15
Polymorphisms
identifying, 19
Polyphagous arthropod pests
life systems of, 467–93
Polyphenisms, 693–95
Polyphenol oxidase, 407
Population dynamics
regional, 476
Population genetics
and cyclodiene resistance, 449–66
Population structure, 292–93
Post-capping stage, 531
Potassium
amino acid uptake in presence of, 114–17
Precipitin test, 276–77

Predation
affect on growth rates, 91–92, 102
reducing, 127
responses to risk of, 354
size-specific, 347
See also Natural enemies
Predators
mechanisms for habitat management of arthropod, 177–83
Prediction and the Allen Paradox
and loss of biomass, 98–99
Preservation
See Specimen preservation
Presocial wasps, 124–25
Prey
alternative, 181–82
interactions on, 138–39
live, 127
malaxation of, 127
selective pressures on Lepidopteran, 139–40
theft of, 138
Prey capture and handling
in social wasps, 126–28
Prey cues
olfactory, 124, 128–30
Principles of Insect Physiology, The, 266, 268
Priority research, 563–64
Problem-solving skills
learning and practicing, 558–59
Producer acceptance, 187–88
Production
secondary, 84
of social wasps, 143
of stream insects, 83–110
See also Agricultural production
Progeny size in arthropods
evolutionary ecology of, 341–69
fitness consequences of, 345–46
optimal, 342
trade-offs with number, 343–45
variation among females within populations, 349–55
variation among species and populations, 346–49
Projection neurons (PNs)
anatomy and physiology of, 207–8
Propheromones, 620
Protease activity, 112
Protein phosphorylation, 775–76
Proteomics
linking QTL mapping with, 415
Proteus mirabilis, 71, 73
Provisioning behavior, 124–25
short versus long term, 176
Pseudogenes, 15
Pteronarcyoidea family, 727
Pteronarcyidae family, 727–28
Publication
parallel, 759
Pulp foraging, 123–24
Pulsatile organs
accessory, 495–518
Pupal stage in insect production, 99–100
a biomass sink, 99–100
Culicoides, 309
mortality in, 99–100, 427
respiration and molting in, 99
Pyrethroids, 377

Q

Quality control, 560
See also Host quality
Quantitative trait loci (QTL), 395–416
Quarantine regulations, 647–48

R

Radar, 274–75
Radiolabeling, 246, 250, 275–76, 612
Radiotelemetry, 273–74
Random amplified polymorphic DNA (RAPD), 15, 290
in molecular systematics, 18–19, 394
Rapid growth rates
larval, 89–90
Rdl crossresistance, 450–51, 460–61
rDNA
nuclear, 4, 10
"Reaction norm" view of scaling, 664–65, 667
Rearing temperature
affect on egg size, 352–53
Receptor homologue
human low-density lipoprotein, 250
Receptors
See Lipophorin receptors; Olfactory receptor neurons
Recruitment, 132–37
field-based mechanisms of, 134–36
nest-based mechanisms of, 133–34
poorly developed in social wasps, 136–37
Redundancy
pheromone communication system showing, 215–16
Regioisomers
See Epoxide regioisomers
Region template
affect on growth rates, 90–91
Regional population dynamics, 476
Registration
using parapheromones, 621

Regulation
of substrate mobilization in insects, 237–39
of tissue growth, 688–90
Remedies
See Ancient remedies
Repetitive DNA, 17
Reporter molecules, 298
Rescue
of phenotypes associated with the locus, 452–53
Research
impact of Internet on entomology, 756–62
models of, 563
Research literature
predicted move to Web, 758–62
Research needs
lipid mobilization, 251
maggot therapy for burns and tumors, 72
Resistance
biochemistry of, 374–77
detecting, 456–57
esterase-based, 374–75
glutathione S-transferase-based, 375
host plant, 393, 647
in insect vectors of human disease, 372–74
molecular biology of, 377–84
monooxygenase-based, 375–76, 381
tagging and mapping loci in plants, 393–422
target-site, 376, 381
Resistance to dieldrin (Rdl)-mediated crossresistance, 450–51
Resources
for insect resistance, 393, 415–16
interactions and access to, 137–39
provision of, 176
See also Carbohydrate resources
Responses
See Excitatory responses
Restriction fragment length polymorphisms (RFLP), 15, 290, 292
in molecular systematics, 18, 394, 399
Reverse transcriptase PCR (RT-PCR), 16
Reversibility lipid binding, 245
Review of Applied Entomology, 266
RFLP
See Restriction fragment length polymorphisms
Rhagoletis juglandis, 434
Rhythms
described, 771
Rice innovations, 561–63
hybrid rices, 562
new plant types, 562–63
transgenic rices, 562
Rice integrated pest management (IPM)
implementation of, 553–64
maturation of, 550–53
Rift Valley fever, 309
Rotations, 384
Royal Entomological Society of London, 264, 759
RT-PCR
See Reverse transcriptase PCR
Rubidium markers, 185

S

Sampling
in molecular systematics, 14
Sandflies
resistance in, 373
See also *Culicoides*
Sarcophagidae, 57–58
Satellite DNA sequences, 17, 291
Scale
in habitat management, 185–86
in morphological structures, 664–70
Scaling releationships, 662–64
changing slope of, 691–92
discontinuous, 694–96
evolution of, 666–70
mechanisms of, 690–91
nonlinear, 696–97
sigmoid, 694–96
survey of, 670–81
Schistocerca gregaria, 221–22, 639
Scopuridae family, 719–20
Sealing junctions
See Blood barriers
Seasonality, 353–54
of *Culicoides*, 322, 325–27
Secondary productivity
of stream insects, 84, 94
SECs
See Strategic extension campaigns
Seeds
selecting clean, 644
Segmentation
genetic control of, 277
Selection
effect on progeny size, 346–47
Semiochemical-based pest control strategies
parapheromones in, 605–30
Senses of Insects, The, 268
Sensor
hydrophobic, 245
Sensory cueing
host, 435
tritrophic patterns in, 440–41
Sensory structures
genes in, 781
Sepharose matrices, 248

Septate junctions
pleated-sheet, 155–57
Sequence alignment, 19–20
Sequence information, 251
Sequence polymorphism
identifying, 19
Sequencing
See DNA sequencing; Insect sequences
Sequential cropping, 469
Seroconversion, 327
Serotonin, 219
Sex attractant pheromones, 204, 575–603
Sexual selection, 661
Shelter
and microclimate, 179–81
Shifting mosaics, 467
Short-latency excitatory responses, 207
Short life cycles
larval, 89–90
Shuttle hypothesis
lipophorin, 242, 246
Sigmoid scaling relationship, 694–96
Silk production
and loss of biomass, 95–96
Simple sequence repeats (SSRs), 394
Simulium damnosum
resistance in, 373–74
Single-stranded conformational polymorphisms (SSCP), 15, 457
in molecular systematics, 19
Site selection, 644
Sitophilus spp., 640
Slow growth rates
larval, 88–89
Slow Paralysis virus (SPV), 536
Smith-Fretwell model, 342–43, 346
Smoking
to control varroa, 530
Snag communities
stranding in, 90
Social control
pheromones for, 520
Social wasps
an introduced species, 140–42
in biological control, 142–43
colony development among, 131
cues in location and choice of prey, 129–31
ecological impact of, 122
feeding biology of, 142
foraging behavior of, 121–50
orientation flights, 128–29
phylogeny, 123
prey capture and handling, 126–28
prey specificity, 125–26
Society for Neuroscience, 267
Sodium
amino acid uptake in presence of, 114–17
Sodium channels, 377, 382–83
Software tools
aids in developing cybercourses, 755
Solitary wasps, 124–25
Southern blots, 451
Southern continents
Arctoperlaria on, 736–38
Spatial arrangement
in habitat management, 185–86
Specialization
host, 440
See also Membrane specializations
Species delimitation, 292–93, 329
Species trees
gene trees versus, 20
Specificity
of fat body lipases, 236
of prey in social wasps, 125–26
Specimen identification
verifying, 25
Specimen preservation, 525
for molecular study, 23–24
unpredictable variation in, 19
Spodoptera exempta, 639
S. littoralis, 211
Spraying
focal, 371–72
SSCP
See Single-stranded conformational polymorphisms
SSRs
See Simple sequence repeats
Staining
dopamine, 219
immunocytochemical, 220
Stator limbatus, 351
Steinerema, 287–99
Stereospecific synthesis, 238
Sterile insect technique, 275–76
Stoneflies, 709–46
Storage pests, 640
controlling, 645
Strains, 288–89
Stranding
contributing to pupal mortality, 99–100
in snag communities, 90
Strategic extension campaigns (SECs), 556, 564
Stream insects
life history and production of, 83–110
Strepsiptera, 3
Stress symptoms, 524
Strip-management
weed, 187
Structural genes
mutations in resistance, 377–78

Students
nontraditional, 753–54
Styloperlidae family, 728–29
Subspecies
interconversions of lipophorin, 241–42
Substrate
regulation of mobilization in insects, 237–39
specificity of lipid transfer particles, 247–48
Superfamilies, 241
Supernatural significance
of pest outbreaks, 646
Suppression of mite reproduction trait (SMRT), 531–32
Survival-reproduction tradeoffs, 436–37
Syllabus and notes
online, 749–50
Sylvatic cycle
remains unknown, 310
Sympatric species
sharing pheromone components, 583, 585–86
Symport system, 113
Synaptic input, 206–7
Synchrony
egg-hatching, 87–88
Synergism
with pheromones, 613–14
Synteny
among genomes of related plant taxa, 415
Synthesis
of epoxide components of pheromones, 594–96
of hydrocarbon components of pheromones, 592–94
stereospecific, 238
Systellognatha group, 726–29
Systematic Entomology, 264
Systematics
of *Apis*, 534
See also Molecular systematics

T

Tachykinins, 220
Taeniopterygidae family, 720–21
TAG
See Triacylglycerol
Tagging
insect resistance loci in plants, 393–422
major genes and QTLs for plant resistance to insects, 398–99
Target-site resistance, 376, 381
Taxa
previous research on, 2–4, 266–67
selecting ingroup and outgroup, 14
Taxonomic databases, 758
Teaching entomology
impact of Internet on, 747–67
Technological innovations, 273–79, 563–64
comprehending, 551–52
reason for growth in distance education, 753
wrong educational use of, 751
See also individual innovations
Technology transfer paradigm, 554–57
TEM
See Transmission electron microscopy
Temperature
effect on *Culicoides* infection, 319–21
rearing and oviposition, 352–53
Tenebrio molitor, 116
Testes
genes in, 784–85
Tetranychus urticae, 476–77
Theory and modeling
contributions to habitat management, 188–89
Thermoregulation, 511
Thoracic gills, 714
Threshold traits, 680–83
development of, 693–94
uncoupling phenotypes of large and small individuals, 683–85
uncoupling phenotypes of males and females, 685–86
working of, 693–96
Tidal flow, 503
Tight junctions (TJs), 156–58
formation of, 162
maximizing, 169
tim gene
discovery and characterization of, 774–75
regulation of, 775
sensitivity to light, 776–77
Time
adjusting planting and harvesting, 643–44
Time coding, 216–18
Time limitation
and progeny size, 346
Time sinks
computer learning as, 751
Timescale factors, 427
Tissue growth
hormones and the regulation of, 688–90
TJs
See Tight junctions
Topclass
software program, 755
Tracheal mites
controlling, 521–26
Trade-offs
progeny size, with number, 343–45
Trail pheromones, 143

Training and Visit (T&V) Extension System, 555–56
Trait expression
facultative, 686
Transcriptional regulation
esterases, 378–79
Translocation, 237
Transmission
explosive, 325
Transmission electron microscopy (TEM), 152, 157, 269
Transport
of amino acid in insects, 111–20
forager, 139
of insect glutamate, 116–18
Transport biochemistry
lipid, 233–60
Trapping
using parapheromones, 619–20
Traps, 321, 323
to control varroa, 530
Tree of Life, 21, 25, 758
TreeBASE, 21, 25
Trees
correctly identifying root of, 14
gene versus species, 20
reconstructing, 20
Trehalose, 235
Tri-State Agricultural Distance Delivery Alliance, 753
Triacylglycerol (TAG)
hydrolysis to diacylglycerol, 234, 238
Tribolium castaneum, 459
Trichogramma, 429
Trichoplusia ni, 117, 215
Tricorythodes atratus, 97
Trifluoromethyl ketones, 612, 617–18
Tritrophic patterns
in sensory cueing, 440
Tropical Asian irrigated rice
integrated pest management with, 549–74
Tropilaelaps clareae, 532
T&V
See Training and Visit Extension System

U

Ultracold freezing, 23
Ultraviolet spectrometry, 587
Uncultivated hosts, 472
Uniport system, 113
United Nations Food and Agriculture Organization (FAO), 554, 632

V

Vacuum sampling, 183
Variegated landscapes, 188–89, 191
Varroa jacobsoni, 519
Varroa mites, 439, 526–32
detecting, 528–29
life cycle, 526–28
symptoms, 528
Vector populations
management of, 384–85
Vectorial transfer, 248
Vectors
arbovirus, 307–40
Vertebrate adipocytes
regulation of hormone-sensitive lipase in, 236–37
Vesicular stomatitis, 309
Vespidae, 124
Vespula germanica, 133–37, 140–41
V. maculifrons, 137
V. vulgaris, 128, 131, 141
Video systems, 277–78
Vineyard parasites, 185
Viruses
associated with *Culicoides*, 309–17
associated with varroa, 535
Visual prey cues, 128–30, 135

W

Wasps
See Social wasps
Water foraging, 123–24
Weather
effect on *Culicoides*, 321–29
Web, The
See World Wide Web
Web CT
software program, 755
Weed strip-management, 187
Western Governors University (WGU), 753
Wing characteristics, 308, 501, 503–5
in Plecoptera, 712
Women's participation
in rice production, 561
World Bank, 372
World Health Organization (WHO), 72, 371–72
World Wide Web, 748
learning to search, 752, 762
sites on, 267, 747–67
Wound debridement, 70–71
Wound healing
See Maggot debridement therapy
WWW
See World Wide Web

X

Xenobiotics
metabolism of, 375

Z

Zoogeography
of the plecoptera, 733
Zoological Record, 266